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Correlates of coping based on the concept of the sociotype: a secondary data analysis of an Israeli National Survey

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ABSTRACT

Background and objective: the sociotype and its domains – Individual Health (IH), Relationships (R) and Context (C) – extends the bio-psychosocial model as an ecological construct that interacts with the genotype to determine phenotypic behavior throughout life. The sociotype framework enables classifying both the nature of stress and the varying responses to it. This paper provides empirical evidence for the sociotype and examines its relation to perceived coping.

Design and methods: we conducted a secondary analysis of a cross-sectional survey on health inequalities in a representative Israeli Jewish sample of 1328 individuals, 30–70 yrs (45% men). Thirty variables were arranged into the above domains and composite scores calculated from sequential regression analyses. A coping score (CS) was determined from questions relating to mastery and coping efficacy.

Results: The mean population CS was 5.09 (SD 1.03; range 1.50–7.20); 5.23 for men vs. 4.97 for women ($p < .00001$). On univariate analysis, CS was not related to age; there were positive associations with health behaviors, education and economic situation and negative ones with smoking, stress and living alone. Correlations *between* the three domains ranged from 0.353 to 0.421 (all at $p < .001$). The individual contributions of each of the sociotype domains to the CS was 31.5% for IH, 16.8% for R and 17.8% for C; when combined they explained 32% of the variance. This was higher in men (40.7%) than in women (26.0%), who valued context more than relationships.

Conclusions: In this population, the domains of the sociotype were related to perceived coping: longitudinal studies can determine its best predictors and the significance of any gender differences. The sociotype ecological model requires further testing in different settings, and for other phenotypic behaviors and responses to stresses, such as coping with chronic disease (adherence to medication) (IH), bereavement (R) and economic hardships (C).

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Sociotype; individual health; relationships, context; ecological mode; coping; stress; cross-sectional study

Introducing the ecological model of the sociotype

It is commonly accepted that a person is the product of his/her genes (genotype, DNA, nature) and the environment (nurture), which together determine his/her observable characteristics and behavior, or phenotype. We have extended the ecological model of Bronfenbrenner (Bronfenbrenner, 1980) and the bio-psychosocial framework of Engel (Engel, 1977; Engel, 1982) to formulate the concept of the sociotype (Berry, 2011; Berry & DeGeest, 2012). Bronfenbrenner's ecological *model* highlights multiple environmental levels that influence behavior that can be divided into the patient-, the micro-, the meso- and the macro (Bronfenbrenner, 1980). The sociotype is a *construct* that consists of three domains: Individual Health (IH), Relationships (R) and Context (C). The sociotype also incorporates a multi-level perspective and has been developed to highlight the importance of an extended bio-psychosocial perspective (championed by Engel), which combined medical reductionism with the psychosocial aspects of the behavioral sciences concerned with 'problems of living' (Engel, 1977; Engel, 1982). The sociotype adds to these intra- and inter-personal inputs a further outer ecological layer concerned with the contextual environmental influences on phenotypic responses. Thus, the sociotype, with its three domains, is a summary ecological construct *to organize the multiple, dynamic, reciprocal inputs from the environment* that interact with the genotype (the latter is not part of the present study) to determine the expression and behavior of the phenotype throughout life. Advances over the past 50 years have led to a vast literature on the nature and understanding of the human genome, and recent work on epigenetics is beginning to show that environmental influences may also affect the expression of the genotype (McEwen, 2016). However, while the inputs of the genotype on the phenotype are relatively stable, those of the sociotype are constantly changing with experience and circumstances. The sociotype defines the intra-personal, inter-personal and extra-personal determinants of behavior.

The term <sociotype> was apparently first used by Bogardus (1950) to represent the effects of society on behavior in a very general way; however, it was not developed further. The current usage positions the sociotype to understand the determinants of an individual's behavior and ability to adapt/cope to life situations in health and disease. The three domains proposed for the sociotype are in line with ecological models for assessing environmental influences on human behavior (Sallis, Owen, & Fisher, 2008).

Figure 1 shows the ecological model of the sociotype. The entries in each of the three domains are not exhaustive and depend on the behavior under study. There is no one 'normal' sociotype as each individual's upbringing and personality determine responses to different stress situations (Berry, 2011; Berry & DeGeest, 2012). The 'success' of these behavioral patterns is dependent on the inputs from the sociotype.

The IH domain includes physical and mental well-being, intelligence (intellectual and emotional), personality and an individual's existential philosophy regarding purpose and spirituality. It takes into account growth, development, upbringing and accumulative life experiences, as discussed extensively by Konner (Konner, 2010).

Inter-personal relationships stand for the cumulative influences of interactions with parents, family, school, friends, coworkers, professional advisors, health care workers, significant others and more. The arrows in Figure 1 underneath Family and Work refer to the directionality of the relationships – with parents, siblings, with and children in the case of family and with employers, colleagues and juniors at work.

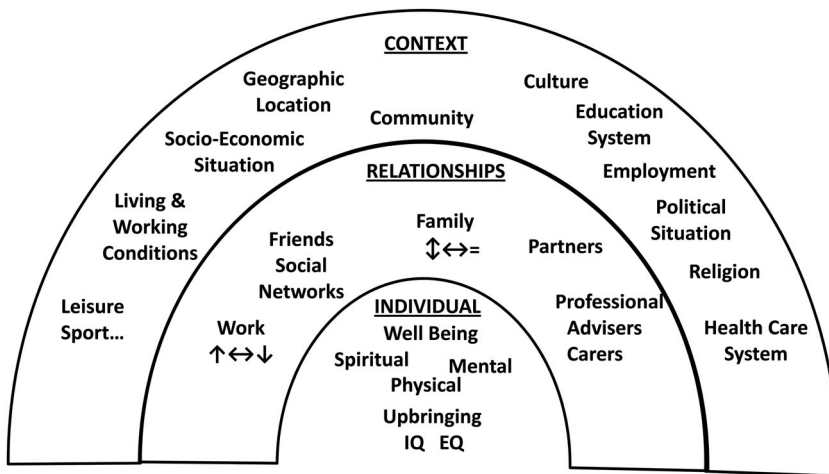


Figure 1. Ecological model of the sociotype. IQ, intelligence; EQ, emotional intelligence.

The contextual inputs describe the wider environmental influences on a person's development and responses. They represent, among others, demographics, education, employment, socio-economic position, work and home conditions and relations to culture, society and political situations.

Obviously, some of the inputs in [Figure 1](#) interact and cross dimensions. For example, schooling reflects the type and quality of education (context), while relationships are also involved with teachers and peers. Similar considerations apply to job satisfaction. The choice of the ecological model and its three domains comes from a number of sources. Antonovsky pioneered the notion of salutogenesis in relation to coping (Antonovsky, 1979, 1987) and identified three relevant areas – personal, social and ecological – which correspond well to the sociotype classification. The ecological model has long been used in the study of human behavior and in the management of chronic disease and coping (Bronfenbrenner, 1979; Kazak, 1989; King et al., 2010; McLeroy, Bibeau, Steckler, & Glanz, 1988; Rogers-Warren & Warren, 1977; Winterhandler, Smith, Winterhalder, & Winterhalder, 2000).

Sociotype and behavior

The many levels of the sociotype determine health behaviors and coping with life situations, which are the practical expressions of its influence. The former include lifestyle, diet and activity (Berry & DeGeest, 2012), as well as substance abuse, self-management and sexual practices (Sallis et al., 2008). The major stresses in a person's life (Miller & Rahe, 1997) may be positioned within and between the different domains. Illness primarily affects the individual, but it has effects on family relations and resources, and, if chronic, on employment and finances as well. In the other direction, job dismissal or retirement may affect status and finances with repercussions on family life and health (Laszlo et al., 2010). Therefore, the ecological framework of the sociotype allows defining both the type of stress and the domains involved in the responses to it.

This paper examines the role of the sociotype in relation to coping. It posits that individual adaptation and coping skills are a function of the cumulative experiences and reciprocal interactions between the three sociotypic domains.

The concepts of coping

Understanding coping strategies is fundamental to understanding how a person functions. Coping with stresses throughout life is part of normal growth and development (Lazarus, 1966). Failure to cope may cause psychological morbidity (Thoits, 2010) and predispose to increased physical illness (Miller, Chen, & Parker, 2011). Over the past decades, there have been many attempts to classify healthy coping and resilience (Herrman et al., 2011), as well as the measurement of coping and stress (Folkman & Moskowitz, 2004; Matheny, Aycok, Curlette, & Junker, 1993; Somerfield & McCrae, 2000).

Concerning etymology, coping has acquired a number of meanings, often used interchangeably with kindred concepts as mastery, defence and adaptation (Pearlin & Schooler, 1978; White, 1974). Definitions of coping include: constantly changing cognitive and behavioral efforts to manage specific external and/or internal demands of the person-environmental interactions that are appraised as taxing or exceeding the resources of a person (Lazarus and Folkman, 1984, p. 141) (Folkman, Lazarus, Gruen, & DeLongis, 1986); and anything people do to adjust to the challenges and demands of stress to reduce its negative impacts (Red Cross, 2003). Resilience is an allied concept defined as a pattern of positive adaptation in the context of past or present adversity (Masten & Wright, 2005).

Coping responses

Some see coping as a linear pathway from the stress event → appraisal → coping → event outcome and its emotional response, whether positive or negative (Folkman, 2008). Others consider that coping is a more re-iterative process requiring constant re-assessment and re-adjustment (Carver, Scheier, & Weintraub, 1989). There is a broadly accepted conceptualization of the structure of coping, with distinctions between emotion- and problem-focused coping (Aldwin & Revenson, 1987; Baker & Berenbaum, 2008; Lazarus & Folkman, 1984; Skinner, Edge, Altman, & Sherwood, 2003). In terms of the sociotype, emotion-focused responses involve principally the IH domain, while problem-focused solutions will involve more the R and C domains. Other factors involved in coping with stress (Miller & Rahe, 1997) include personality (individual) and gender (Carver & Connor-Smith, 2010; Gough, 1987), value systems and culture (Bilsky, Janik, & Schwartz, 2011) and views concerning quality of life (context) (Claes, Van Hove, van Loon, Vandeveld, & Schalock, 2010; Shye, 2010).

In attempts at classification, Skinner and coworkers have listed around 400 (*sic*) ways of coping and have reduced them to 12 families of coping involving three adaptive processes (Skinner et al., 2003; Skinner & Zimmer-Gembeck, 2007). These are to coordinate (1) preferences and available options; (2) reliance and social resources available and (3) actions and contingencies in the environment. These processes correspond to the sociotype domains of IH, Relationships and Context.

The above is an over-simplified summary of the main motifs from the vast literature on coping. It highlights that coping is a multidimensional dynamic process that unfolds over time and experience with multi-level reciprocal interactions of a person throughout life (experiences) with the environment (Herrman et al., 2011). Thus, coping behaviors depend on the nature of the stress, on the background of the genotype and on the influences of the sociotype.

The purpose of this paper is to test the explanatory value of the sociotype by determining the associations of its three domains with coping in a normal population. It might be assumed that the better the life circumstances (or functioning) of the domains, the better the coping skills, but the strength of their relative contributions is not known, nor whether there may be gender differences in their influences.

We have re-analyzed the results from a cross-sectional survey which investigated the influence of socio-economic inequalities on self-rated health in Israel (Soskolne & Manor, 2010). Since this study assessed many of the variables that relate to the sociotype (including coping and mastery), the dataset provided an opportunity to examine the empirical basis of the sociotype construct in relation to stress, given that Israelis live under constant geo-political pressures.

Methods

Data were collected by interview using structured questionnaires covering (1) demographic variables; (2) individual self-reported health; (3) psychosocial variables (including coping and mastery skills); (4) health behaviors and (5) socio-economic position. In the original analysis IH was the designated dependent (outcome) variable. We constructed a new dependent variable – coping score (CS) (described below).

The following is a summary of the relevant details of the sampling methods and questionnaires used.

Population sample and sampling

A national representative random sample of Jewish Israeli citizens aged 30–70 years living in urban areas was selected in stages. First, using stratified sampling, only urban local authorities were chosen from the Israeli Central Bureau of Statistics (CBS) list, based on the size and socio-economic rank (CBS, 1999), yielding 54 local authorities. Second, within these authorities, statistical areas in which Jewish residents comprised more than 50% of residents were selected (1190 statistical areas). Third, the statistical areas were stratified according to three factors: geographical region of the country (4 regions), religiosity (orthodox, religious or not orthodox) and socio-economic score (a range of 20 ranks). Random sampling of statistical areas was conducted in each stratum, based on its size and the size of the population, resulting in 49 statistical areas. In the final stage, 50 addresses were randomly sampled from each statistical area. Of these, 1958 households were eligible for the study (the others were non-residential, incorrect addresses or households with persons ineligible for inclusion). One person in each household was interviewed, alternating between men and women. A total of 1328 (68%) persons completed the interview, 521 (27%) refused to be interviewed and the rest were not located after four visits.

Data collection

The study was approved by the Hebrew University – Hadassah Review Board. Data were collected in late 2003 from face-to-face home interviews in Hebrew or in Russian (following the influx of immigrants from the FSU in the 1990s). Community socio-economic scores were retrieved from the CBS (CBS, 1999).

Variables and measures

Arrangement of variables by the three domains of the sociotype.

Thirty variables from the survey were selected and grouped into the three domains of the sociotype – IH, Relationships and Context (formerly called Environment) as shown in (Figure 2) (Berry, 2011).

The choice of these variables was dictated by the original survey, which did not include other relevant inputs such as the use of alcohol and income. Classification of these variables may not be static as there are reciprocal interactions between, and within, the dimensions. Physical and mental health may affect relationships (and vice-versa), while job stress and economic situation (C) may influence the other two domains. Religiosity is a combination of upbringing (R) and context; adult religious identification is a personal choice and considered in the IH domain. Health behaviors (diet and smoking) are both determinants of health as well as outcomes of personal choice. Despite these reservations, a classification was decided upon in line with the sociotype theoretical ecological model that could be tested for collinearities.

The following description identifies the variables used in Figure 2 by their domains of the sociotype – Individual Health (IH, variables 1–12), Relationships (R 1–8) and Context (C 1–10).

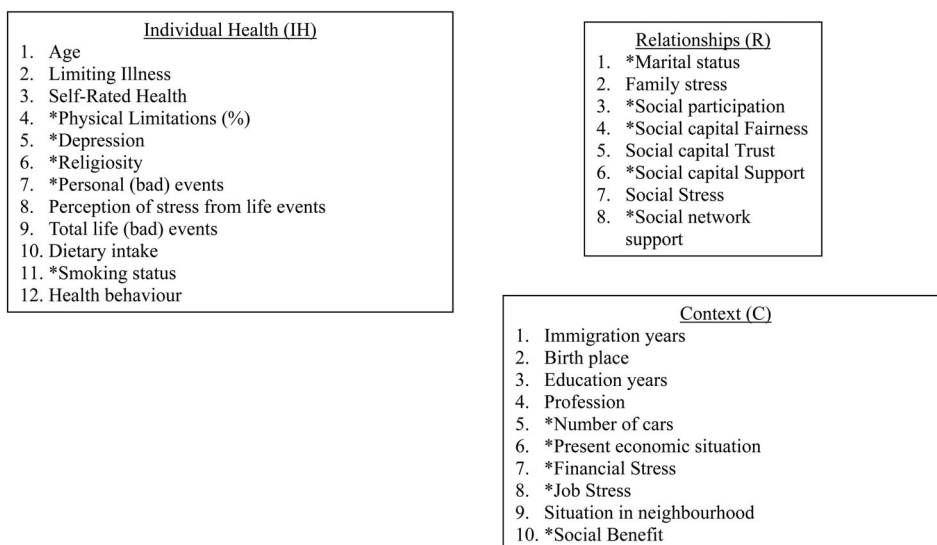


Figure 2. Arrangement of the study variables into the three domains of the sociotype. Descriptions of the variables in the three sociotype domains – Individual Health (IH, variables 1–12), Relationships (R 1–8) and Context (C 1–10) – are described in the Methods section. * Variables that were found by regression analysis to contribute to the summary scores for each domain (see Results section).

Individual Health domain

Questions on stress related to family (R), employment or finances (C) covered more than one domain and have been classified appropriately.

- (1) Demographic variables: age (IH 1), gender, physical limitations (IH 4) and religiosity (secular, traditional, religious) (IH 6).
- (2) Individual self-reported health measurements: two global indicators of morbidity were selected: assessment of limiting long standing illness (IH 2). This was a 'no' vs. 'yes' measure of functional limitation, intended to focus on chronic conditions that impair an individual's daily activities (Manor, Power, & Matthews, 2001). Assessment of Self-rated health (IH 3). This was measured using a 5-level ordinal single item of an overall assessment of health (Idler & Benyamini, 1997). For the analyses, this indicator was dichotomized into '0' good (very good and good) vs. '1' poor (fair, poor and very poor). Mood / Depression (IH 5). Mood was assessed for the week prior to the interview. Answers were rated from 0 (excellent mood) to 3 (very low mood, with feelings of loneliness, sadness and sleep disturbances).
- (3) Individual psychosocial variables: brief questionnaires that had satisfactory psychometric properties and were suitable for health surveys (Karlsson, Sjostrom, & Sullivan, 1995) were preferred over lengthy questionnaires to reduce respondent fatigue. Several psychosocial variables having a highly skewed distribution were dichotomized by choosing up to the lowest third to denote low levels of each measure vs. the highest two thirds. Stressors: scales were used, adapted from a study on health differences (McDonough & Walters, 2001). (1) *Recent life events* measured positive responses to nine events that happened to the respondent, or someone close, in the past year, including an item unique to the situation in Israel at the time of the study (exposure to terror) (IH 8). (2) *Chronic stressors* measured positive responses to an 8-item scale, divided into 4 sub variables reflecting finances (C 7), social life (R 7), family relationships (R 2) and work stress (C 8). These two scales were further dichotomized into '0' low (no event or 0–3 chronic stressors), or '1' high levels (1+ events or 4+ chronic stressors).

Cognitive appraisal of the stressors was assessed by rating each of the life events experienced, ranging from '1' – not at all, to '5' – to a large extent. The sum score was dichotomized into '0' low stress (mean scores of 0–6), or '1' high stress (score of 7 or more). Summary questions recorded personal bad events and total life bad events (IH 7 and 9).

4: Health behaviors: Two items – smoking (IH 11) and Health Behavior (IH 12) (physical activity and use of sun-screen) were taken from previous surveys in Israel (Tamir, Dayan, Weinstein, & Arin, 1998) together with a question on sensible diet including fruits, vegetables, proteins, grains and dairy products (IH 10) (Pandey, Hart, & Tiwary, 2003). The response categories to all the items were recorded on a 4-level ordinal scale. (1) Smoking – never smoked, past smoker, current light smoker and current heavy smoker. (2) Physical activity lasting at least 20 min – everyday, 1–2 times/week, seldom and never. (3) Use of sun protection – always, sometimes, seldom and never. (4) Diet – very balanced, balanced, somewhat unbalanced, not at all balanced. For the analysis, a scale of health behaviors was calculated as the mean of these four behaviors, ranging from '1' – healthy behaviors, to '4' – unhealthy behaviors.

Relationships domain

- (1) *Demographic*: marital status (R 1).
- (2) *Social capital*: this adopted the structural/cognitive distinction that differentiates between the concepts of civic engagement – the extent to which citizens involve themselves in their communities, and the cognitive perception of mutual trust and solidarity among community members (Kawachi, Kennedy, Lochner, & Protow-Stith, 1997). Since data on civic engagement (as measured at the community level by per capita group membership) is not available in Israel, we relied on the respondents' reports (R 8).
- (3) *Social participation* was measured by nine items adapted from a scale of membership in formal or informal groups (R 3) (Lindstrom, Hanson, & Ostergren, 2001), and by a civic engagement measure used in the United States (Kawachi et al., 1997), ranging from '0' not at all/ rarely, to '2' very often. Cronbach's alpha was 0.68. Social trust was assessed by three 'yes' vs. 'no' items that measured 'perceived lack of fairness' (R 4), 'social trust' (R 5) and 'perceived helpfulness' or support (R 6) (Kawachi et al., 1997), all categorized as '1' negative vs. '0' positive response.

Context domain

- (1) Demographic: year of immigration (C 1), country of birth (C 2) and profession (C 4).
- (2) Two widely used measures were selected for *socio-economic position*. Level of education (C 3) was measured as years of schooling, and further collapsed into four levels: 0–8 years, 9–12 years, 13–15 years and 16+ years. Financial assets were measured as the number of cars in the household's possession and categorized into three levels: none, one, two or more (C 5) (Galobardes, Shaw, Lawlor, Lynch, & Davey Smith, 2006). Present economic situation was compared to other families, judged on a 5-point scale from 'much better' to 'much worse' (C 6). Sources of income identified participants who received social benefits (C 10).
- (3) *Neighborhood living conditions* – were assessed by an 11-item scale measuring socio-environmental problems such as noise, litter and rubbish, vandalism and burglaries (C 9) (Steptoe & Feldman, 2001). Each item ranged from '1' – not a problem, to '3' – a severe problem. The items were summed, with higher scores representing severe problems.

Constructing the coping score

In the original survey, coping and mastery were measured by two questions on coping efficacy and mastery:

- (1) *Coping efficacy*: two face-valid items assessed efficacy in coping with daily disruptions and emotional stress caused by the *most severe recent event* (Manne & Glassman, 2000).

- (1) 'How well do you think you are dealing with the changes and disruptions to your life imposed by the event?'

- (2) ‘How well do you think you are dealing with the emotional stresses imposed on you by the event?’

Both items were rated on a 5-point Likert scale from 1 (*not well*) to 5 (*extremely well*). The correlation between the two items was .70. Higher scores represented higher coping efficacy. The mean was 7.12 (sd 1.71, range 2–10).

(2) *Mastery*: A seven item scale was used to measure the ability to deal with/control issues as they arise in people’s lives (Pearlin & Schooler, 1978).

How strongly do you agree or disagree that:

- (1) I have little control over the things that happen to me
- (2) There is really no way I can solve some of the problems I have
- (3) There is little I can do to change many of the important things in my life
- (4) I often feel helpless in dealing with the problems of life
- (5) Sometimes I feel that I’m being pushed around in life
- (6) What happens to me in the future mostly depends on me
- (7) I can do just about anything I really set my mind to do

Each question was answered on a 4-point scale; 1 indicating low levels and 4 high levels of mastery. The total score was divided by seven; the mean was 3.06 (sd 0.63). Cronbach’s alpha was 0.84.

An exploratory principal component factor analysis was performed on seven variables, considered *a priori*, to be involved into positive and negative aspects of sociotype-coping from an informed review of the literature. These were: mastery, coping efficacy, total life events, personal life events, chronic stress, cognitive perception of stress from total life events and depression.

Two factors explaining 63.81% of the total variance were apparent after a varimax rotation. Mastery and coping efficacy had the similar highest loadings and were the best representatives of the variables determining coping. This justified calculating a composite coping and mastery efficacy score, designated the CS from a simple average of the two original variables. The mean of the combined variable CS from 1311 subjects was 5.09 (range 1.50–7.20) with a standard deviation of 1.03. The distribution was quite symmetrical with only a small, prolonged left tail (skewness -0.59 and kurtosis 0.29). The correlation between the two was 0.429 , indicating that these variables were not orthogonal.

Statistics

Associations between the CS and categorical variables were tested using *t*-tests or ANOVA. For numeric variables, the associations are presented as the slopes of linear regressions. Explanatory variables were grouped into the three sociotypic domains. For each domain a composite score was constructed in order to analyze its association with the CS. The procedure consisted of an inspection and elimination of collinearities followed by a stepwise forward linear regression.

Statistical analyses were carried out using SPSS version 20. Significance was set as $p < .05$.

Results

Data were collected from 1328 individuals (45% men) aged between 30 and 70 years. The mean age was 48.2 yrs (SD = 11.9). The majority (76%) were married; 54% were born in Israel, 28% immigrated before 1990 and 18% since 1990 (almost all from the FSU): 47% defined themselves as secular, 35% as traditional (observing the main religious traditions) and 17% as religious. The demographic characteristics of the final sample were very similar to those of the general Jewish population (CBS, 2004), indicating the representativeness of the sample.

1: Univariate relationships.

Table 1 shows the univariate relationships between variables from the three sociotypic domains and the CS. The reference groups were those subjects with the 'preferred' state for example, low stress, good mood, satisfactory finances, etc. This was used as exploratory information for the selection of variables to be included in the multivariate regressions. The relationships are given either as regression coefficients or as the differences (Δ s) in the CS between the subjects with high or low levels of the specified variable. Contrary to intuition, age was not associated with the CS, while the other positive or negative relationships in the table follow what might be expected, such as negative associations with smoking, stress, living alone; and positive relationships with health behaviors, education and economic situation.

2: Calculation of the summary scores for each of the three domains of the sociotype.

For each of the three sociotype domains, a composite score was derived that measured the association of their respective variables from Figure 2 with the CS. The procedure

Table 1. Coping score relationships with selected variables within the three domains of the sociotype – individual health, relationships and context.

Variable	Mean	SD	Difference (Δ) from reference group without the problem
Total population ($n = 1311$)	5.09	1.03	Range 1.50–7.0
<i>Individual health</i>			
Age	48.16	11.90	No association ($p = .10$)
Limiting Illness + ($n = 330$)	4.73	1.12	$\Delta -0.48$ ($p < .001$)
Bad self-rated health ($n = 103$)	4.11	1.13	$\Delta -1.06$ ($p < .001$)
Physical limitation (14.63%)	86.77	23.08	$r = 0.33$ ($p < .001$)
Depression	0.51	0.66	$r = 0.51$ ($p < .001$)
Bad life events ($n = 337$)	4.74	1.07	$\Delta -0.46$ ($p < .001$)
High stress ($n = 402$)	4.72	1.08	$\Delta -0.53$ ($p < .001$)
Smoking current ($n = 387$)	4.95	1.09	$\Delta -0.20$ ($p = .003$)
Health behaviors	2.14	0.69	$r = 0.20$ ($p < .001$)
Religiosity	1.70	0.75	Traditional have lower coping ($p < .05$)
<i>Relationships</i>			
Living alone ($n = 312$)	4.80	1.15	$\Delta -0.37$ ($p < .001$)
Family stress	1.19	0.26	$r = 0.27$ ($p < .001$)
Social participation	0.83	0.37	$r = 0.29$ ($p < .001$)
Low social capital ($n = 386$)	4.84	1.10	$\Delta -0.35$ ($p < .001$)
Low trust ($n = 795$)	4.98	1.10	$\Delta -0.28$ ($p < .001$)
Low social support ($n = 298$)	4.70	1.18	$\Delta -0.50$ ($p < .001$)
Social stress	0.41	0.41	$r = 0.10$ ($p < .001$)
<i>Context</i>			
Education in years	2.59	0.97	Monotonic increase in coping ($p < .001$)
Number of cars	0.76	0.69	Monotonic increase in coping ($p < .001$)
High financial stress ($n = 579$)	4.74	1.06	$\Delta -0.64$ ($p < .001$)
High job stress	0.26	0.31	$r = 0.18$ ($p < .001$)
Chronic stress ($n = 307$)	4.66	1.05	$\Delta -0.56$ ($p < .001$)
On social benefits ($n = 159$)	4.54	1.18	$\Delta -0.62$ ($p < .001$)

consisted of an inspection and elimination of collinearities followed by a stepwise forward linear regression.

Domain: Individual Health (n = 1303, missing 25)

Collinearities:

Six variables 'Cognitive perception of stress from total life events', 'Use of medical services', 'Use of medical specialist', 'General use of medical services', 'Health behaviors' and 'Total life (bad) events' were removed to eliminate collinearities.

The final model involved five variables ($R^2 = 0.300$, $p < .001$) with the following equation:

$$\text{Individual Health Score} = 5.17 - 0.68^* \text{ Depression} - 0.01^* \text{ Physical Limitations} \\ - 0.25^* \text{ Personal (bad) events} - 0.09^* \text{ Religiosity} - 0.05^* \text{ Smoking Status.}$$

Domain: Relationships (n = 1143, missing 185)

To avoid collinearity, the variable 'Support' was represented only by its dichotomized version that presented a higher variance inflation factor. In addition, the three variables 'family stress', 'social stress' and 'chronic stress' were removed because of collinearities.

The final model involved five variables ($R^2 = 0.151$, $p < .001$):

$$\text{Relationships Score} = 4.69 + 1.15^* \text{ Social Participation} + 0.06^* \text{ Social Network} \\ - 0.30^* \text{ Marital Status} + 0.19^* \text{ Social Capital, Fairness} + 0.13^* \text{ Social Capital, Support.}$$

Domain: Context (n = 885, missing 443)

In a univariate analysis, the variable 'Immigrant years in Country' was not associated with the CS.

Collinearities: 'Last education institute' was excluded because of collinearity with 'Education years'. Education and Profession were included in the original univariate analyses but were not significant in the final model which involved five variables ($R^2 = 0.147$, $p < .001$):

$$\text{Context Score} = 5.66 - 0.48^* \text{ Financial Stress} - 0.13^* \text{ Relative Present Economic} \\ \text{Situation} - 0.36^* \text{ Job stress} - 0.23^* \text{ Social Benefit} + 0.11^* \text{ Number of Cars.}$$

3: Contribution of the domain scores to the coping score.

The next stage in the analysis was to use the above domain summary scores to assess the relative contributions of each to the CS. The correlations between the CS and the three sociotype domains were: IH 0.548 ($n = 1287$), R 0.388 ($n = 1129$) and C 0.383 ($n = 878$) respectively; all at $p < .001$. The correlations *between* the three domain scores ranged from 0.353 to 0.421. All correlations at $p < .001$.

When regressed *singly* against the CS, IH domain variables explained 31.5% of the variance, R 16.8% and C 17.8%. Because of their interactions, a stepwise regression was then made with the CS against the domain scores *collectively*. This gave a final regression equation as

$$\text{CS} = -2.93 + 0.76^* \text{ Individual Health Score} + 0.40^* \text{ Relationships Score} \\ + 0.43^* \text{ Context Score}$$

All coefficients were significant at $p < .0001$. In the first step, the IH domain contributed 26.8% to the explanatory variance, and subsequently R added 3.5%, followed by C 1.9%. All three domain scores accounted for 32.2% in the variation in the CS.

4: The three sociotype domains by gender

In the total study population, the CS was 5.23 (sd 0.99) for men (n 583) and 4.97 (sd 1.05) for women (n 728) – highly significant at $p < .00001$. The breakdown of the scores for each domain by gender is shown in Table 2. For men, all three domain scores were similar and each significantly higher than the values for women where the R domain score was higher than that of both IH and C.

The final stage of the data analysis was to report for men and women separately the summary domain statistic scores (as in 2 supra) derived from the regression equations to assess (a) the separate contribution of each domain to the CS and (b) the combined effects of all three domains.

Step 1: For each domain and gender stepwise forward multivariate regressions of the CS on the variables included in the domain were performed.

Step 2: Each of those 6 regressions was repeated including only the variables statistically significant in step 1. The separate contributions of the three domains totaled 75.3% in men (IH 35.8%, R 19.9%, C 19.6%) and 57.3% in women (IH 26.6%, R 14.5%, C 16.2%).

The CS predicted by those regressions were calculated and saved as a single variable summarizing the associations of each domain by gender with the CS.

Step 3: For each gender, a final regression was performed with the three domain variables. Note the reduction in sample sizes, as these regressions were restricted to those cases with all three values.

For 323 men:

$$\text{Coping Score} = 0.43^* \text{ Individual Health} + 0.18^* \text{ Relationships} + 0.14^* \text{ Context} - 2.32$$

$$R^2 \times 100 = 40.7\%$$

For 412 women:

$$\text{Coping Score} = 0.32^* \text{ Individual Health} + 0.16^* \text{ Context} + 0.12^* \text{ Relationships} - 2.32$$

$$R^2 \times 100 = 26.0\%$$

All three domains showed a statistically significant effect on the CS ($p < .001$).

Table 2. Coping scores of the separate sociotype domains for men and women.

Men	Individual Health	Relationships	Context	One way ANOVA
Mean coping score	5.230	5.226	5.236	$F = 0.069$ $p = .934$
Sd	0.596	0.441	0.438	
N	572	550	571	
Women				
Mean coping score	4.978	5.039	4.986	$F = 3.339$ $p = .036$
sd	0.538	0.388	0.419	
n	724	598	704	
	$p < .0001$	$p < .0001$	$p < .0001$	

Judging by the magnitude of the standardized coefficients, for men: IH had the greater impact on the CS (the steepest slope) followed by R and to a less extent C. For women, the order of R and C was reversed.

Discussion

The sociotype is a construct that interacts with the genotype to determine different phenotypic characteristics throughout life. Our results provide empirical evidence of the relevance of the sociotype and the relative contributions of its three ecological domains – individual health, relationships and context – to the particular behavior of coping and mastery.

The sociotype framework is involved in both the assessment of the stress and the responses to it, based on a person's experiences and available resources. A feedback loop occurs whereby coping responses to stress are evaluated as being helpful, or not, leading to appropriate modifications in behavior, and these cycles will continue until optimal coping is achieved.

The determinants of coping and mastery are many: they are crucial for adapting to life stresses, both acute and chronic, and their choice is dependent on the circumstances. In this exploratory investigation, we conducted a secondary analysis of data on health inequalities from in Israel (Soskolne & Manor, 2010). Many of the variables used were relevant to the sociotype domains (Figure 2) for their associations with the measures used for coping efficacy and mastery (Pearlin & Schooler, 1978) (Manne & Glassman, 2000).

On univariate analysis, the finding that age was not significantly related to coping was unexpected and counter-intuitive, as was the lack of a relationship with support from a religious identity (Allen & Marshall, 2010; Bartlett, Piedmonr, Bilderback, Matsumoto, & Bathon, 2003; Wachholtz, Pearce, & Koenig, 2007). Poor health behaviors – smoking, diet, activity and sun protection – were associated with weaker coping skills. Directionality is problematic since coping with stress could influence smoking habits. These findings may open the way for re-enforcing lifestyle interventions. Many of the other results were intuitively predictable, such as the negative influences of depression and stress, whether in the family, financial or at work, and the positive effects of education and good health.

Regarding the *individual* contributions to the CS, IH domain scores explained 31.5% of the variation, R 16.8% and C 17.8%.

The variables in the IH domain in relation to coping all had negative coefficients (depression, physical limitations, personal bad events, religiosity and smoking). For R, they were all positive (social participation, social network, marital status, social capital fairness and support). In the C domain they were all negative (financial stress, relative economic position, job stress and on social benefits) with the exception of car ownership as a proxy for income. There were significant correlations *between* the 3 domain scores (0.353 – 0.421) of 'medium' importance (Cohen, 1988): this is not surprising given the complexity of the areas that they represent and how a given situation for example, loss of a job or bereavement can affect more than one domain. However, these figures translate to between 12% and 18% explanatory interdependencies and

thus, there is justification for treating the three domains separately for both classification of variables and their analyses.

We believe that the *net* explanatory value of the sociotype (around 33%) may be an underestimate, and that, given a more dedicated, designed study with more carefully selected variables, it should be possible to increase the understanding of the determinants of coping and use more detailed modeling analyses. What accounts for the remaining 60–70%? The elements of coping are multifactorial, and future research is needed to characterize the genetic component(s) or, rather, the genetic-environment interactions involved (Jang, Thordarson, Stein, Cohan, & Taylor, 2007). These authors noted in a study on twins that personality factors were not very strong predictors of coping.

Gender differences in coping and the sociotype

When the CSs were examined by gender, men had a statistically significantly higher value of 5.23 vs. 4.97 for women. It remains to be studied what is the *practical* meaning for such a difference of 0.26 points, given that the sample sizes were so large. In the breakdown for each domain separately (Table 2), men had similar significantly superior scores in all three domains than women, where the relationships score was higher than the other two. The next analyses were performed on a reduced sample size, to determine the *net* domain effects when combined. From the stepwise regressions this was 32.2%, higher in men (40.7%) than in women (26.0%).

In both genders, IH was found to be the principal determinant of coping. Part of the explanation of this may be due to the inclusion of personal (bad) life events and depression in the IH score. These two variables were originally used (and rejected) in the explanatory principal component factor analysis of coping-related variables; People experiencing them would be more likely to report difficulties in coping, and we are aware of the overlap between their influences on the ability to cope.

After IH, the next domain in rank position differed between men and women. In men, relationships preceded context while in women the opposite applied. This might have been expected since prior research indicates that marital status often has a stronger impact on men's health than women's (Robards, Evandroua, Falkingham, & Vlachantoni, 2012).

However, we do not want to make too many far-reaching conclusions from these gender-sociotype results. Rather, our findings warrant further investigation. We might suggest that women are more socialized than men, with additional roles, but in the long-term, they value financial stability (C). They are indeed more vulnerable to economic insecurity, especially if their relationships dissolve. They are paid less than men for similar jobs, and as has been noted in the USA: 'Every woman with a child is just one man away from being on welfare.' Men are more job-oriented, yet do poorly when living on their own, to explain their greater dependency on relationships and 'old boys networking'. Our results relate to coping in general but not to a given, specified stress situation. Such future studies might give a more nuanced understanding of the relationships between coping, gender and the sociotype domains.

Application of the sociotype to analyze both stress situations and coping strategies

The types of, and responses to, stress may be classified according to the ecological model of the sociotype as in the following examples.

Individual Health: – stress cancer. Enhancing optimistic expectations of the future and promoting a sense of coherence (IH) reduced distress in cancer patients and their partners. (Gustavsson-Lilius, Julkunen, Keskivaara, Lipsanen, & Hietanen, 2012)

Relationships: – Stress Divorce – effects on adolescents. Among 127 divorced and 308 two-parent families, higher levels of self-control (IH) and social support (R) were found to mitigate possible adverse effects of parental divorce on adolescents' aggression. (Hamama & Ronen-Shenha, 2012)

Context (1): – Chronic stress after missile attacks in Israel. Researchers found that marriage (R) buffers against symptoms of traumatic stress for men, and that social support ('tend and befriend') (R) counteracts it in women. (Israel-Cohen & Oren Kaplan, 2015)

Context (2): – Cross culture: A cross-sectional study, on 10,941 adolescents from 20 countries, tested the impact of region and gender on stress perceptions and coping styles, in four areas (school (C), parents, peers, and romantic relationships (R)). Perceived stress in the different spheres were universally similar among adolescents. Coping styles characterized by negotiating, seeking support (R), and emotional outlets were used more often by adolescents, especially women, from Western than those from the Eastern/Asian or Southern regions. All adolescents showed more emotions to conflicts with parents than with peers or romantic partners. (Persike & Seiffge-Krenke, 2012)

Stress along 20-year life trajectory: In simultaneous predictive models, the variables – women, more threat appraisal, stressor severity, social resources (R), and depressive symptoms (IH), and fewer financial resources (C) – were independently associated with higher initial levels of coping responses. There was a significant decline over time in approach and avoidance coping strategies. (Brennan, Holland, Schutte, & Moos, 2012)

Limitations of the study

Although the wide range of the original study by Soskolne and Manor allowed classifying the variables into the appropriate domains of the sociotype, they were not chosen *a priori* as those best to represent either coping or the domains themselves. For example, education and car possession were used as surrogates for socio-economic status: this is acceptable (Galobardes et al., 2006) but not ideal. The optimal variables that make up the dimensions of the sociotype will depend on the question under study.

These results are from an anonymous cross-sectional study and do not allow determining what indicators, within the sociotype, are predictive of coping skills. The data only give information about associations between the variables that may be modified to improve coping skills, such as health behaviors and improved social support. These will need to be tested in future interventional and/or longitudinal studies. Other issues concern the generalizability of the results, which require further surveys in different populations, within (urban vs. rural) and between geographic locations (countries), as well as considerations of cross-cultural differences. There is no one normal sociotype response. It depends on the person, his surroundings and his previous life experiences, and is therefore very

culture specific/dependent. However, the ecological model is ‘universal’ in that it applies to any given individual, in a given circumstance and in response to a given stress.

Future research

This article has not dealt with the challenges of the metrics of well-being (Robson, 2014), stress (Miller & Rahe, 1997), coping (Folkman & Moskowitz, 2004; Matheny & Curlette, 2010; McCubbin et al., 1983; Somerfield & McCrae, 2000) or the values associated with quality of life (Shye, 2010) (Claes et al., 2010) (Bilsky et al., 2011), and cultural differences (He & van de Vijver, 2015), and how they may be related to the sociotype. Further, it is necessary to define the biological (and possibly gender) pathways involved in stress and coping, such as allostasis (Juster, McEwen, & Lupien, 2010; Sterling, 2012) and epigenetics (McEwen, 2016), and relate them to the functioning of the sociotype. Future plans (using mixed methods) are to develop a composite index for the sociotype and its three domains, analogous to the work done, for example, on the multi-dimensionality of food security and sustainability (Berry, Dernini, Burlingame, Meybeck, & Conforti, 2015).

This study has considered the role of the sociotype in coping in a normal population. In disease situations, elements of the sociotype may support patients and help their families and medical teams improve coping with the stresses of chronic illness. The ecological model provides a framework through which health professionals may study coping according to the circumstances – chronic illness, divorce, bereavement, immigration, loss of a job, retirement and more (Miller, Brody, & Summerton, 1988; Miller & Rahe, 1997). Each stress situation demands its own list of relevant variables for both its assessment and coping strategies, with different emphases on the separate domains.

Further, the sociotype framework needs to be applied to phenotypic expressions other than coping. Examples include lifestyle and health behaviors such as diet (obesity, eating disorders) (Berry & DeGeest, 2012), physical and sexual activity and substance use, and responses to stresses in the three domains such as dealing with chronic disease (adherence to medication) (IH), bereavement (R) and economic hardships (C).

Envoi

The current work provides evidence for the validity of the structure of the three domains of Individual Health, Relationships and Context as part of the sociotype and their associations with coping and mastery skills. A final question arises: why do we need another concept such as the sociotype? We believe that it is a practical, ecological, organizational framework to understand the environmental interactions that determine phenotypic behavior throughout life. In this context, we may apply the saying from Ecclesiastes 4:12 that ‘a threefold cord is not quickly broken’ to refer to the Genotype, Phenotype and the Sociotype.

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